Third Workshop on Affective Brain-Computer Interfaces: Introduction

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The human mind – and hence the brain – is fascinating in its complexity, and its exploration holds many promises for the development of mankind. For computer science and especially human-computer interaction, brain-computer interfaces (BCI) enable direct access to the information represented in the brain, allowing scientists and engineers to use this information to help users interact with applications and devices. Over the last decade, BCI research developed into a major research field establishing methodological frameworks, guidelines and a community of dedicated researchers. Besides proving valuable as a communication channel that bypasses impeded muscular pathways, these technologies are also spurring novel applications for able-bodied users in fields such as entertainment, health and lifestyle.

Affective BCI systems allowing users to control computer games, support relaxation training, or trigger your alarm clock during a shallow sleep stage have been proposed, implemented, and sold. Moreover, the affordable hardware and software tools also encouraged artists to play with the idea of a direct access to people's most private information: their affective and cognitive states. From these explorations followed a number of interesting installations, suggesting novel ways of human-computer as well as human-human interaction: neurotechnology-based systems that encourage affective self-reflection, the synchronization and empathizing between or the competition of different minds, and the collaborative creation and manipulation of multimedial content.

Following the first and second workshop on affective brain-computer interfaces, held in conjunction with ACII in Amsterdam (2009) and Memphis (2011), the third workshop explores the advantages and limitations of using neurophysiological signals for the automatic recognition of affective and cognitive states, and the different ways to use this information about the user in applications within the health, arts, and entertainment domains. The goal is to bring researchers, artists, and practitioners together to present state-of-the-art progress, discuss pitfalls and limitations and share and create visions, and thereby encourage the development of guidelines and frameworks for affective BCI.

The contributions featured a large range of interesting topics. The most works explore the classification of affective states via different neurophysiological measurements, such as Electroencephalography (EEG), functional near-infrared spectroscopy (fNIRS), and functional magnetic resonance imaging (fMRI). Other works study the inclusion of additional physiological signals, such as muscular activity, electrodermal measurements, or heart rate, for the detection of emotions. In this context techniques for the identification of different electrophysiological signal sources, multimodal data fusion methods, and non-linear feature extraction approaches are discussed. Other contributions treat methodological problems, like the generalization of a (workload) classifier from the specific context in which it was trained to a more complex task and the search for suited evaluation criteria for affect classifiers. An unusual but valuable perspective is taken by works that look at the influence of affect on active BCI performance: Is the emotional state of BCI users a critical factor for their capability to control thought-based interaction and if so, what can we do to put them in the optimal state? Finally, theoretical contributions elucidate the value of BCI for the arts and for industry.

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